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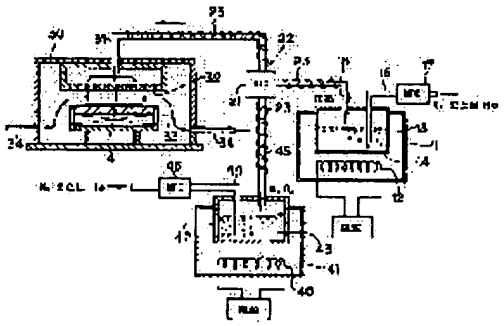
(54) FORMATION OF THIN FILM

(57)Abstract:
PURPOSE: To obtain a fluidal compact thin film which has an excellent step coverage against wiring patterns having high aspect ratios by using gaseous hydrogen peroxide together with gaseous tetraethyl orthosilicate.
CONSTITUTION: Liquid tetraethyl orthosilicate (TEOS) 14 and liquid hydrogen peroxide 43 are supplied to a mixer 21 after gasification. The mixer 21 produces a reactive gas by mixing the gaseous TEOS and hydrogen peroxide with each other and supplies the reactive gas to a plasma CVD reaction furnace 30 through a pipeline 22. The reactive gas introduced into the furnace 30 by suction from the inlet 31 of the furnace 30 is blown from a shower electrode 32 and generates plasma under a high-frequency voltage, resulting in the formation of a silicon oxide film on a wafer 4 to be processed placed on a susceptor 33. Therefore, a fluid compact film which has an excellent step coverage against wiring patterns having high aspect ratios can be formed.



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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The thin film formation method characterized by making the hydrogen peroxide of the tetraethyl orthochromatic silicate of a liquid, and a liquid evaporate, supplying a reactor in a plasma CVD method as mixed gas of the hydrogen peroxide of the shape of a gas-like tetraethyl orthochromatic silicate and a gas, and making a silicon oxide form in the wafer front face in this reactor.

[Claim 2] The thin film formation method of the claim 1 which makes a tetraethyl orthochromatic silicate and a hydrogen peroxide evaporate by blowing the carrier gas which consists of nitrogen or helium into the airtight container with which it filled up with the hydrogen peroxide of the tetraethyl orthochromatic silicate of a liquid, and a liquid, respectively.

[Claim 3] The thin film formation method of the claim 1 which makes a tetraethyl orthochromatic silicate and a hydrogen peroxide evaporate by being dropped at the evaporation room floor line which had the hydrogen peroxide of the tetraethyl orthochromatic silicate of a liquid, and a liquid heated.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the thin film formation method. Furthermore, this invention relates to the new thin film formation method of having used the tetraethyl orthochromatic silicate (TEOS), in detail.
[0002]
[Description of the Prior Art] In manufacture of a semiconductor IC, there is a process which forms the thin film of a silicon oxide on the surface of a wafer. The chemical vapor growth (CVD) is used for the formation method of a thin film. Although there are the three methods of an atmospheric pressure method, a reduced pressure method, and the plasma method in CVD, to the VLSI as which a highly precise thin film is required for the latest high quality, it is observed noting that the plasma method is suitable.
[0003] The plasma method impresses and plasma-izes high-frequency voltage to the reactant gas injected in the vacuum, energy required for a reaction is acquired, good membraneous quality is obtained with the homogeneity of thickness, and, moreover, it excels in many respects -- film formation speed is quick.
[0004] the formation material of the silicon oxide by the plasma method -- for example, SiH4 etc. -- although used, the fall of a step coverage has posed a problem with detailed-izing of a semiconductor device Instead of this mono-silane gas, the tetraethyl orthochromatic silicate (TEOS) [Si (OC two H5)4] of a liquid has come to be used recently. TEOS is because the precise film excellent in the step coverage can be formed. When forming a silicon oxide using TEOS, TEOS is made to heat and evaporate, it considers as TEOS gas, oxygen gas is mixed to this, and a reactor is supplied.
[0005]
[Problem(s) to be Solved by the Invention] However, even if it uses TEOS, if the aspect ratio of wiring exceeds 1.0, an overhang will be produced, consequently a step coverage will fall, and practical use will not be presented.
[0006] Therefore, the purpose of this invention is offering the method of being a good step coverage and forming the silicon oxide of plasma CVD equipment in the circuit pattern of a high aspect ratio, without using the raw material which has an inflammability and/or explosivility.
[0007]
[Means for Solving the Problem] In a plasma CVD method, the aforementioned technical problem makes the hydrogen peroxide of the tetraethyl orthochromatic silicate of a liquid, and a liquid evaporate, is supplied to a reactor as a hydrogen peroxide of the shape of a gas-like tetraethyl orthochromatic silicate and a gas, and is solved by the thin film formation method characterized by making a silicon oxide form in the wafer front face in this reactor.
[0008]
[Function] The thin film of a good step coverage can be formed without producing an overhang in the circuit pattern of a high aspect ratio according to the method of this invention, as mentioned above, since a fluid precise film is formed by using a hydrogen peroxide with TEOS.
[0009] Generally, TEOS is understood an added water part like the following formula.
Si4 (OC two H5) + 2H2 O -> SiO2 + 4C2 H5 OH [0010] It is H2 O2, when it mixes and gas-like TEOS and a gas-like hydrogen peroxide (H2 O2) are supplied to the heated wafer front face. It decomposes into H2 O and active oxygen, hydrolysis of TEOS and decomposition by active oxygen advance, and a good silicon oxide is formed.
[0011]
[Example] Hereafter, an example explains this invention still in detail.
[0012] Drawing 1 is the typical block diagram of an example of the plasma CVD equipment which can be used for enforcing the method of this invention. As shown in drawing 1 , the thermostat 11 maintained by about 40 degrees C - 80 degrees C at a heater 12 is formed, a container 13 is held in the interior, and a liquid TEOS14 is filled by this at suitable height. The nose of cam of a pipe 15 is inserted in the filled liquid, and they are nitrogen gas (N2) or gaseous helium (helium). If carrier gas is blown, Liquid TEOS evaporates, and this will be contained in the foam of carrier gas and will emit from an oil level. The TEOS gas which emitted is taken out with carrier gas, and a mixer 21 is fed with it with a pipe 16. Similarly the thermostat 41 maintained by about 40 degrees C - 80 degrees C at a heater 40 is formed, a container 42 is held in the interior, and liquid H2 O243 are filled by this at suitable height. The nose of cam of a pipe 44 is inserted in the filled liquid, and they are nitrogen gas (N2) or gaseous helium (helium). When carrier gas is blown, it is liquid H2 O2. It evaporates, and this is contained in the foam of carrier gas and emits from an oil level. H2 O2 emitted Gas is taken out with carrier gas and a mixer 21 is fed with it with a pipe 45. It sets to a mixer 21 and is the shape of gas TEOS, and H2 O2. It is mixed, and becomes reactant gas and the plasma CVD reactor 30 is supplied by the charging line 22. TEOS and H2 O2 which were evaporated In order to prevent cooling and liquefying again, the heater tape 23 is ****(ed) around pipes 16, 23, and 45, the suitable current for this is passed, and the temperature of reactant gas is maintained to constant value. It is controlled by the mass-flow controller (MFC) 17 formed in the middle of the pipe 15, and the amount of supply of TEOS is H2 O2. The amount of supply is controlled by the mass-flow controller (MFC) 46 formed in the middle of the pipe 44. The reactant gas which the interior was made into the vacuum by the airtight structure, and was inhaled in

the furnace from the inlet 31 is injected from the shower electrode 32, a reactor 30 is plasma-ized by the high-frequency voltage impressed by the RF generator which is not illustrated, and a thin film is formed in the processed wafer 4 laid in the susceptor 33. Gas [finishing / reaction processing] is discharged by the exhaust air gassing section prepared outside from the exhaust port 34.
[0013] Drawing 2 is TEOS and H2 O2. It is the typical block diagram showing another example of a vaporizer. [usable although the method of this invention is enforced] Liquid TEOS is dropped at a carburetor 60 from a pipe 50, and it is liquid H2 O2 from a pipe 52. It is dropped at a carburetor 60. A carburetor 60 has the heater 62 for heating in the lower part, and heats a floor line 64 to predetermined temperature. TEOS and H2 O2 which were dropped at the floor line from the pipe 50 and the pipe 52 It evaporates and gasifies in a short time extremely, and is mixed in the evaporation room 66. The carrier gas delivery pipe 68 is connected to the evaporation room 66, and a reactor 30 is fed with mixed gas by this carrier gas (for example, N2 or helium) through a pipe 70 from the evaporation room 66. Here, while mixed reactant gas feeds, in order to prevent cooling and carrying out a reliquefaction, the suitable heater tape 72 for the periphery of a pipe 70 is ****(ed), the suitable current for this is passed, and the temperature of mixed reactant gas is maintained to constant value. The amount of supply of TEOS gas, and H2 O2 The amount of supply of gas is controlled by the liquid mass-flow controller 56 formed in the middle of the liquid mass-flow controller 54 formed in the middle of the pipe 50, and the pipe 52, respectively.
[0014]
[Effect of the Invention] As explained above, the thin film of a good step coverage can be formed by the method of this invention, without producing an overhang in the circuit pattern of a high aspect ratio, since a fluid precise film is formed by using a hydrogen peroxide with TEOS.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the typical block diagram of an example of the plasma CVD equipment which can be used for enforcing the method of this invention.
[Drawing 2] TEOS and H2 O2 It is the typical block diagram showing another example of a vaporizer. [usable although the method of this invention is enforced]
[Description of Notations]
4 Wafer
11 41 Thermostat
12 40 Heater
13 42 Container
14 Liquid TEOS
15 44 Pipe
16 45 Extraction pipe
17 46 Mass-flow controller
21 Mixer
22 Mixed Reactant Gas Delivery Pipe
23 Heater Tape
30 Plasma CVD Reactor
31 Inlet
32 Shower Electrode
33 Susceptor
34 Exhaust Port
43 Liquid H2 O2
50 Liquid TEOS Delivery Pipe
52 Liquid H2 O2 Delivery Pipe
54 Liquid TEOS Mass-Flow Controller
56 Liquid H2 O2 Mass-Flow Controller
60 Carburetor
62 Heater
64 Carburetor Floor Line
66 Evaporation Room
68 Carrier Gas Delivery Pipe
70 Mixed Reactant Gas Delivery Pipe
72 Heater Tape

[Translation done.]